Horticulture Technologies

Horticulture Technologies includes standards that challenge students to plan for future food needs, using advanced technologies. These technologies are becoming increasingly important as populations grow and farm land is consumed by this urban growth. Understanding the benefits of these technologies and how to blend their use with environmental conservation is important as we enter the 21st century.

Pre-requisites:	**Any intermediate course in the Horticulture Sub-cluster**
Recommended Credit:	**1**
Recommended Grade Levels:	**11th or 12th**

***** **All learning expectations must be met for the 1 credit in this course.**

Horticulture Technologies

Standard 1.0

The student will evaluate the use of technologically altered plants.

Standard 2.0

The student will explore advanced technologies in horticulture equipment.

Standard 3.0

The student will evaluate the effectiveness of new greenhouse design innovations.

Standard 4.0

The student will assess the efficiency of current and possible future energy sources in horticulture.

Standard 5.0

The student will evaluate the use of different methods of plant tissue culture.

Standard 6.0

The student will assess the use of horticulture technologies for producing crops in space.

Standard 7.0

The student will integrate academic competencies with advanced horticulture technology competencies.

Standard 8.0

The student will develop premier leadership and personal growth to strengthen horticulture technology skills.

Horticulture Technologies

Course Description:
This advanced course will challenge students with technical equipment and expertise used in the horticulture industry. This course includes standards that identify the futuristic need and implementation of horticulture technologies to feed an expanding and growing population.

Standard 1.0
The student will evaluate the use of technologically altered plants.

Learning Expectations:
The student will:
1.1 Evaluate the use of new plant varieties created through genetic engineering.
1.2 Compare processes and methods used in plant genetic engineering.
1.3 Evaluate the process and use of tissue cultures.
1.4 Evaluate the use biotechnological agents to control insects, plant disease and weeds.
1.5 Assess the role that exotic and nontraditional crops of the future may play.

Evidence standard is met:
The student will:
- Compare the benefits of new plant varieties developed through genetic engineering to possible problems.
- Prescribe step-by-step processes and methods used in plant genetic engineering.
- Specify the process used in tissue cultures.
- Compare the effectiveness of biotechnological controls used in the control of insects, diseases and weeds to traditional control methods.
- Determine the role of nontraditional crops for the future.

Integration/Linkages
Mathematics, Chemistry, Biology, Language Arts, Social Studies, Horticulture Industry Standards, Business and Marketing, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks
- Assemble a list of new plant varieties developed through genetic engineering and determine their advantages.
- Prepare a flow chart showing methods and procedures used in genetic engineering.
- Complete an experiment with growing a tissue culture.
- Prepare a portfolio of biotechnological controls for different pests.

Standard 2.0
The student will explore advanced technologies in horticulture equipment.

Learning Expectations:
The student will:
2.1 Evaluate the use of global positioning systems (GPS) in agricultural production.
2.2 Question the use of remote sensing and robotics to increase food production in the future.
2.3 Evaluate the use of computer controlled automated irrigation systems.
2.4 Assess the value of automated plant handling systems.
2.5 Inspect automated plant harvesting systems.
2.6 Evaluate the use of automated transplanting systems.
2.7 Evaluate automated plant production systems.

Evidence standard is met:
The student will:
- Propose situations where global positioning systems can be used.
- Determine how robotics can and will be used in horticulture production.
- Outline how a computer controlled irrigation system works.
- Rate a plant handling system on its efficiency in the field of horticulture.
- Outline the use of plant-harvesting systems.
- Summarize how automated transplanting systems work.
- Determine the benefits and weaknesses of automated plant production systems.

Integration/Linkages
Mathematics, Physics, Chemistry, Biology, Language Arts, Horticulture Industry Standards, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks
- Prepare examples of how global positioning systems are used in horticulture.
- Diagram a layout of a robotics system in a greenhouse.
- Propose why a computer-controlled automated irrigation system would be better than a conventional system.
- Design a totally automated nursery plan and a totally automated greenhouse design.
- Evaluate the active use of a GPS on a farm.

Standard 3.0
The student will evaluate the effectiveness of new greenhouse design innovations.

Learning Expectations:
The student will:
3.1 Evaluate the benefits of different types of automated retractable roof greenhouses.
3.2 Evaluate the use of different types of greenhouse alarm and information systems.
3.3 Operate a simple step controller used in a greenhouse operation.
3.4 Evaluate the use of a roll-top table system for a greenhouse.
3.5 Compare the advantages and disadvantages of different greenhouse coverings.
3.6 Demonstrate how to access stored or current information from a greenhouse computer.

Evidence standard is met:
The student will:
- Explain principles of retractable roof greenhouses and give advantages and disadvantages of each.
- Describe the benefits of installing a greenhouse alarm or information system.
- Program a step controller for a greenhouse operation.
- Draw a layout for a roll-top table system for a greenhouse.
- Based on a crop grown, determine the appropriate greenhouse covering to be used.
- Determine possible types of information that a greenhouse computer could store and the possible uses of this information.

Integration/Linkages
Mathematics, Physics, Business, Language Arts, Horticulture Industry Standards, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks
- Compare advantages and disadvantages of retractable roof greenhouses.
- Explain how greenhouse alarms or information systems can help a grower prevent crop failure.
- Program a step controller for a greenhouse.
- Compare the profitability of designing and constructing a roll-top table system to save space and time too other systems.
- Develop a list of all greenhouse coverings showing advantages and disadvantage of each.
- Access computer programs and information systems to make decisions on greenhouse uses.

Standard 4.0
The student will assess the efficiency of current and possible future energy sources in horticulture.

Learning Expectations:
The student will:
4.1 Evaluate the effectiveness of alternative fuels used in heating a greenhouse.
4.2 Examine the components of a geothermal heating system.
4.3 Determine the possible applications for solar energy use in a greenhouse.
4.4 Evaluate the use of wind for power production.
4.5 Evaluate the use of alternative fuels in a greenhouse.
4.6 Evaluate new technology and advancements in heating and cooling equipment designs.

Integration/Linkages
Mathematics, Chemistry, Language Arts, Horticulture Industry Standards, Physics, SCANS (Secretary's Commission on Achieving Necessary Skills)

Evidence standard is met:
The student will:
- Propose possible alternative fuels that could be used in a specific greenhouse system.
- Determine the components needed for a miniature solar system for a greenhouse.
- Specify the components needed in a wind power generator for a greenhouse.
- Test heating capacity for alternative agricultural fuels.
- Determine the advantages of using advanced heating and cooling technology.

Sample Performance Tasks:
- Determine the heating and cooling efficiency of alternative fuels, such as methanol and bio-diesel.
- Design a miniature solar system for a greenhouse.
- Design a wind-powered generator for a greenhouse.
- Recommend heating and cooling systems for greenhouse use.
- Compare the efficiency of heating and cooling systems of local greenhouses.

Standard 5.0
The student will evaluate the use of different methods of plant tissue culture.

Learning Expectations:
The student will:
5.1 Examine the composition of different tissue culture media.
5.2 Specify the steps used in the sterile technique.
5.3 Specify the steps for preparing a tissue culture.
5.4 Evaluate materials needed in using a tissue culture.
5.5 Determine how tissue culture can positively or negatively affect the horticulture industry.

Evidence standard is met:
The student will:
- Differentiate between tissue culture media.
- Perform a tissue culture using sterile technique.
- Develop a list of materials needed to perform a tissue culture.
- Compare the advantages and disadvantages of using tissue cultures in the horticulture industry.

Integration/Linkages
Mathematics, Biology, Chemistry, Language Arts, Horticulture Industry Standards, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks
- Prepare proper tissue culture media for different plant types.
- Prepare a tissue culture using the sterile technique.
- Prepare the materials needed for a successful tissue culture.
- Give a six-to-eight-minute speech explaining possible ramifications that tissue cultures may have on the horticulture industry.

Standard 6.0
The student will assess the use of horticulture technologies for producing crops in space.

Learning Expectations:
The student will:
6.1 Evaluate why horticulture is needed for space stations.
6.2 Evaluate the process for creating ecosystems in space.
6.3 Relate the use of hydroponics and aquaponic production technologies to crop production in space.
6.4 Assess crops that could be grown in space.
6.5 Evaluate the uses of agriculture wastes in space.
6.6 Examine the use of closed-loop agriculture systems.

Evidence standard is met:
The student will:
- Determine the role horticulture will play in space stations.
- Determine reasons for creating an ecosystem in space.
- Determine how hydroponics and aquaponic systems will work well in space stations.
- Compare the effectiveness of crops that would grow in space stations.
- Develop uses for agricultural wastes in space.
- Describe the components of a closed-loop agriculture production system.

Integration/Linkages
Mathematics, Physics, Biology, Chemistry, Language Arts, Horticulture Industry Standards, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks
- Design and lay out what a horticulture food production system would look like on a space station and develop a plan for the number of people that it would feed.
- Design a plan for utilizing all parts of the ecosystem including agricultural wastes to create a closed-loop system.
- Prepare a list of crops and their nutritional requirements that would perform well and be needed in space.

Standard 7.0
The student will integrate academic competencies with advanced horticulture technology competencies.

Language Arts:
The student will:
7.1 Demonstrate appropriate public speaking techniques in making presentations on the use greenhouse technologies.
7.2 Use appropriate grammar in written and oral communications on greenhouse management techniques.

Science:
The student will:
7.3 Demonstrate the use of biological chemistry processes in plant tissue culture.
7.4 Evaluate biological processes in controlling pests.
7.5 Determine how biological processes and physics might be affected by growing plants on space stations.
7.6 Demonstrate the role that physics plays in cooling greenhouses, especially in retractable roof models.
7.7 Relate physical science to geothermal heating systems.
7.8 Examine principles of physics as they relate to wind power or solar energy.

Mathematics:
The student will:
7.9 Use algebraic equations for determining space savings and increased productions from using roll top tables.
7.10 Use mathematical equations for determining correct fertilization and water rates.

Evidence standard is met:
The student will:
- Examine all biological and chemical processes used in plant tissue cultures.
- Propose the manipulation of biological processes used in controlling pests without pesticides.
- Specify the roles of nontraditional crops for the future.
- Determine the physical properties that affect greenhouse cooling.
- Algebraically determine the space saved on increased production created by using roll top tables.
- Propose physical science properties that relate to geothermal heating and cooling.
- Present how physics is used in wind and solar power.
- Describe how growing crops in space could be affected biologically and physically.

Integration/Linkages
Biology, Language Arts, Algebra, Mathematics, Physical Science, Chemistry, National Standards for Horticulture Industry, SCANS (Secretary's Commission on Achieving Necessary Skills)

Sample Performance Tasks
- Give an oral presentation describing all biological and chemical processes in plant tissue culture.
- Write a paper or report projecting the role nontraditional crops will play in the future.

- Prepare a poster illustrating the physical properties that affect greenhouse cooling.
- Prepare a business plan showing how increased production can be achieved by using roll top tables.
- Prepare an extemporaneous presentation explaining how geothermal heating or cooling works and demonstrate how it relates to physical science.
- Determine the role of physics in wind of solar power.

Standard 8.0

The student will develop premier leadership and personal growth to strengthen horticulture technology skills.

Learning Expectations

The student will:

8.1 Prepare a simulated SAEP, supervised agricultural experience program using an advanced horticulture technology business.
8.2 Demonstrate the use of public speaking skills to persuade people on the use of horticulture technologies.
8.3 Use computer technology to save a business owner time money.
8.4 Evaluate the benefits of various professional organizations for a horticulturist.

Evidence standard is met:

The student will:

- Plan an SAEP that is directly related to advanced horticulture technologies.
- Give a six-to-eight-minute oral presentation and answer questions on some aspect of horticulture technology.
- Develop a four-to-five-minute oral presentation for a group meeting on the use of horticulture technology.
- Prepare a sample spreadsheet showing how new technology can save a business owner money.
- Determine the advantages of belonging to various horticultural associations.

Integration/Linkages

Mathematics, Science, Social Studies, Business, Marketing, Language Arts, Horticulture Industry Standards, SCANS (Secretary's Commission on Achieving Necessary Skills), National FFA Guidelines for Prepared Public Speaking, National FFA Guidelines for Extemporaneous Public Speaking, National FFA Guidelines for Community Education Programs

Sample Performance Tasks

- Give a group presentation presenting an SAEP directly related to advanced horticulture technologies.
- Develop a six-to-eight-minute prepared speech on some aspect of horticulture technology.
- Describe horticulture technology in an extemporaneous speech.
- Develop a spreadsheet illustrating the management of materials and income.
- List membership requirements for two professional horticultural organizations.
- Participate in the FFA Food for America program.
- Participate in the FFA Farm Safety Just 4 Kids program.
- Participate in the America Reads Challenge program.
- Participate in the FFA Partners for a Safer Community program
- Participate in the FFA PALS program.